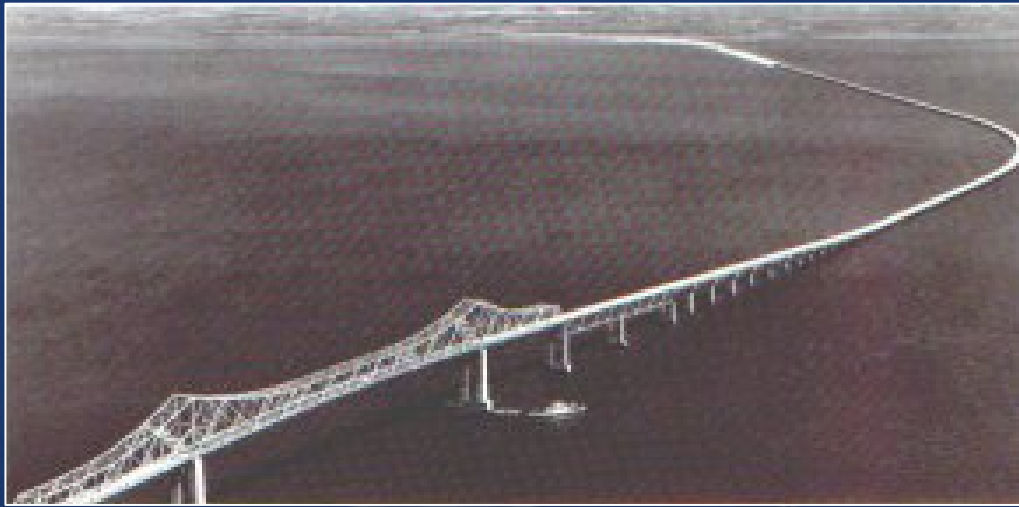




# *Sunshine Skyway Bridge*

## *Yesterday, Today and Tomorrow*



***Presented by:***

***Pepe Garcia, P.E.***

***Steve Womble, P.E.***

***In collaboration with***

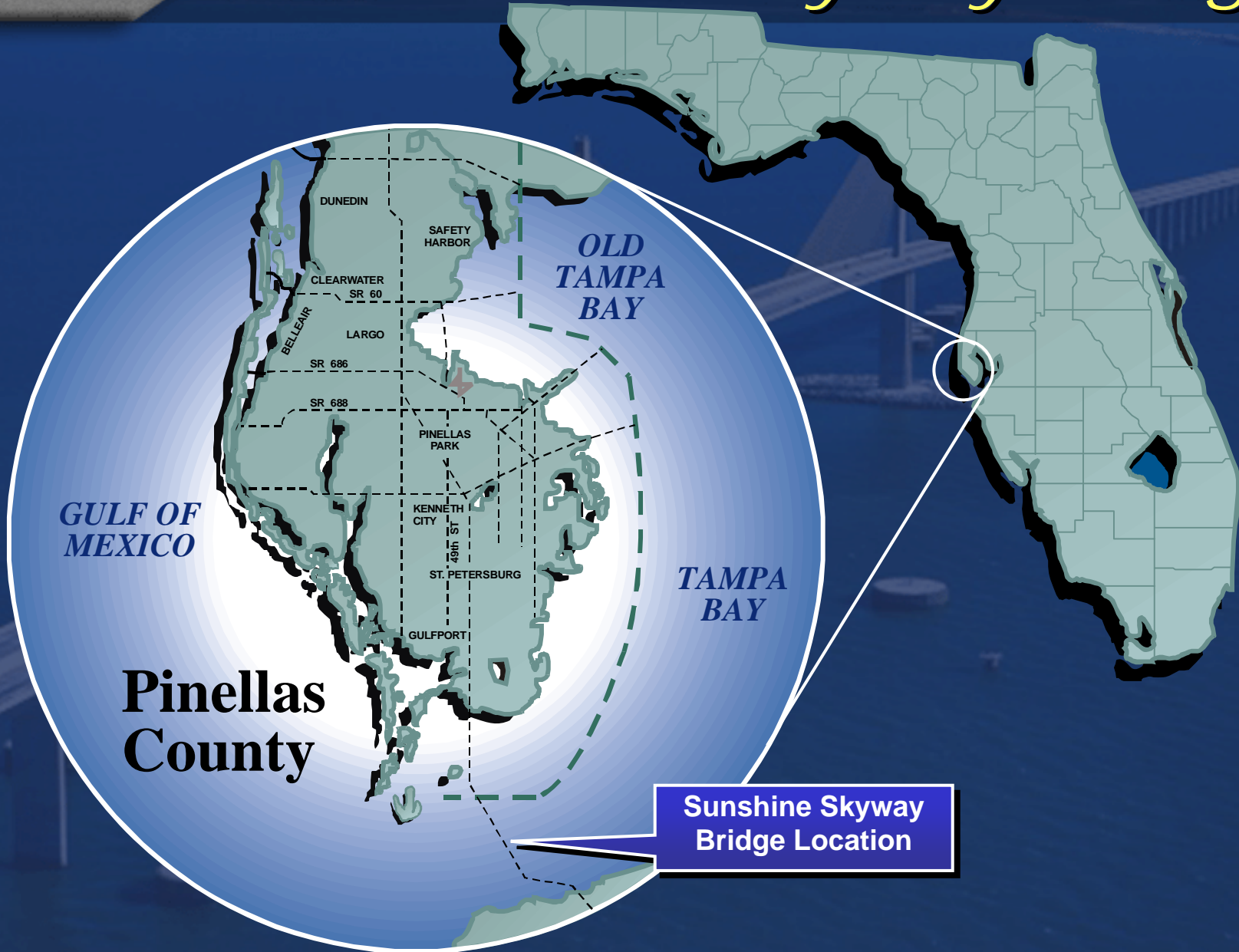
***Atiq Alvi, P.E. and Teddy Theryo, P.E.***

***with Parsons Brinckerhoff***

***May 2006***



# Sunshine Skyway Bridge



GULF OF MEXICO

OLD TAMPA BAY

TAMPA BAY

**Pinellas  
County**

Sunshine Skyway  
Bridge Location

# *Sunshine Skyway Bridge*

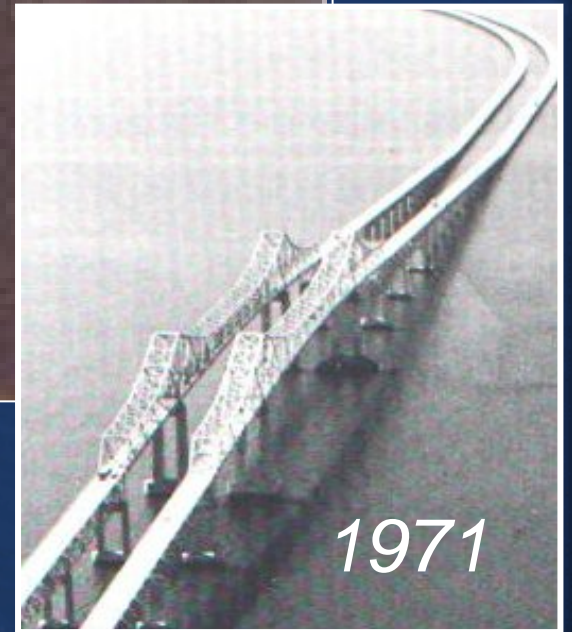
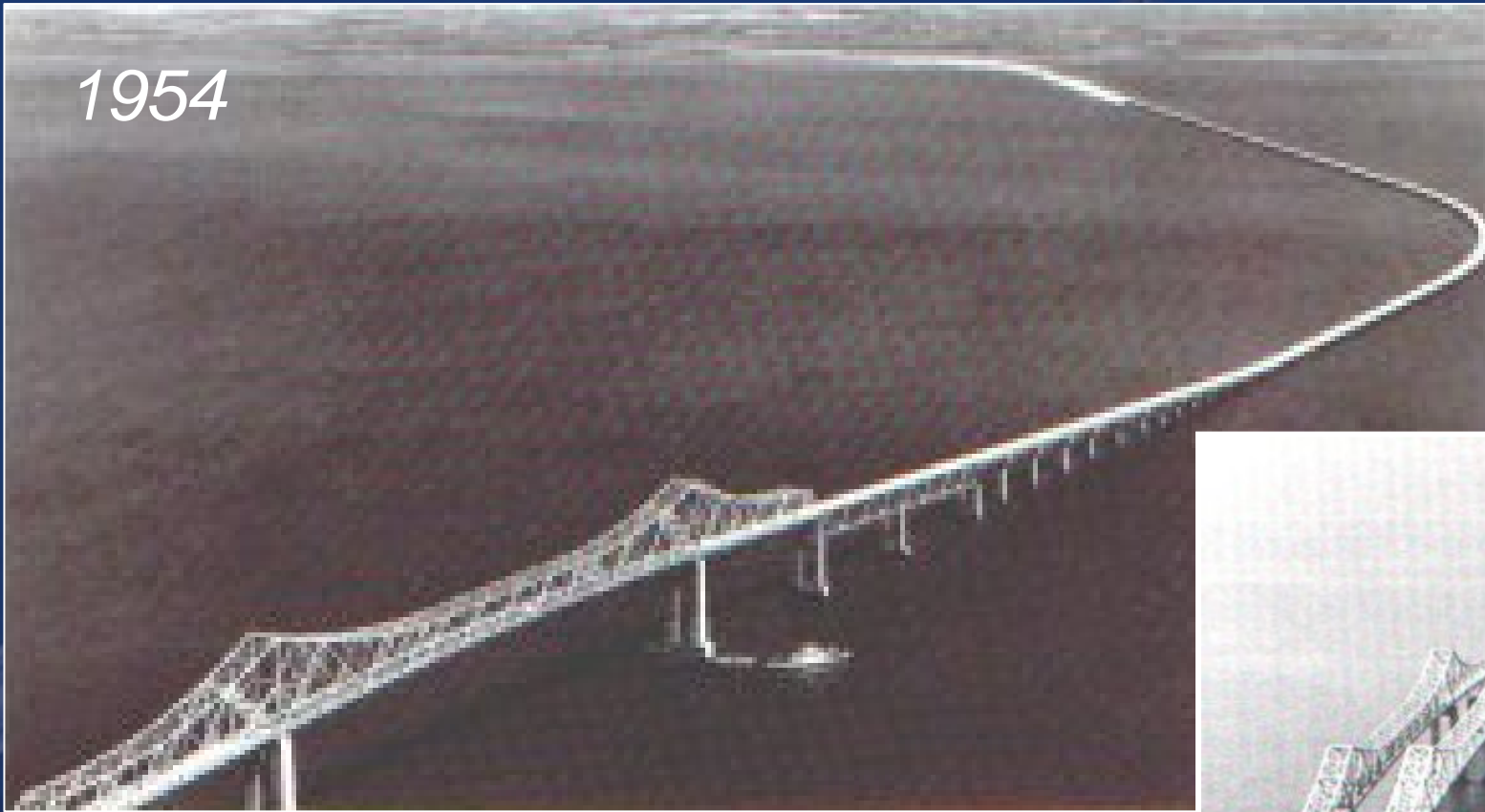
## History

- SEPT. 6, 1954: The \$22 million, 4-mile Sunshine Skyway bridge opens with two lanes between Manatee and Pinellas counties
- MAY 19, 1971: A second two-lane Skyway span is added at a cost of \$25 million. Built west of the original span, it carried southbound traffic
- MAY 9, 1980: A phosphate freighter strikes a Skyway pier during a severe storm. A huge section of the span built in 1971 crumbles into the Bay killing 35 people
- MAY 11, 1980: The undamaged northbound span of the bridge reopens for two-way traffic
- A signature replacement bridge was envisioned by then Governor Bob Graham
- APRIL 30, 1987: A new, \$244 million Sunshine Skyway opens. It is touted as safer than the old bridge. The shipping channel is widened about 50 percent
- The bridge is considered the “flag bridge” of the State
- The bridge receives significant local and national media attention
- The bridge rates Travel Channel’s No. 3 of “Top 10 Bridges”
- NOV. 21, 2005: Bridge named The Bob Graham Sunshine Skyway Bridge

# Sunshine Skyway Bridge

Yesterday...

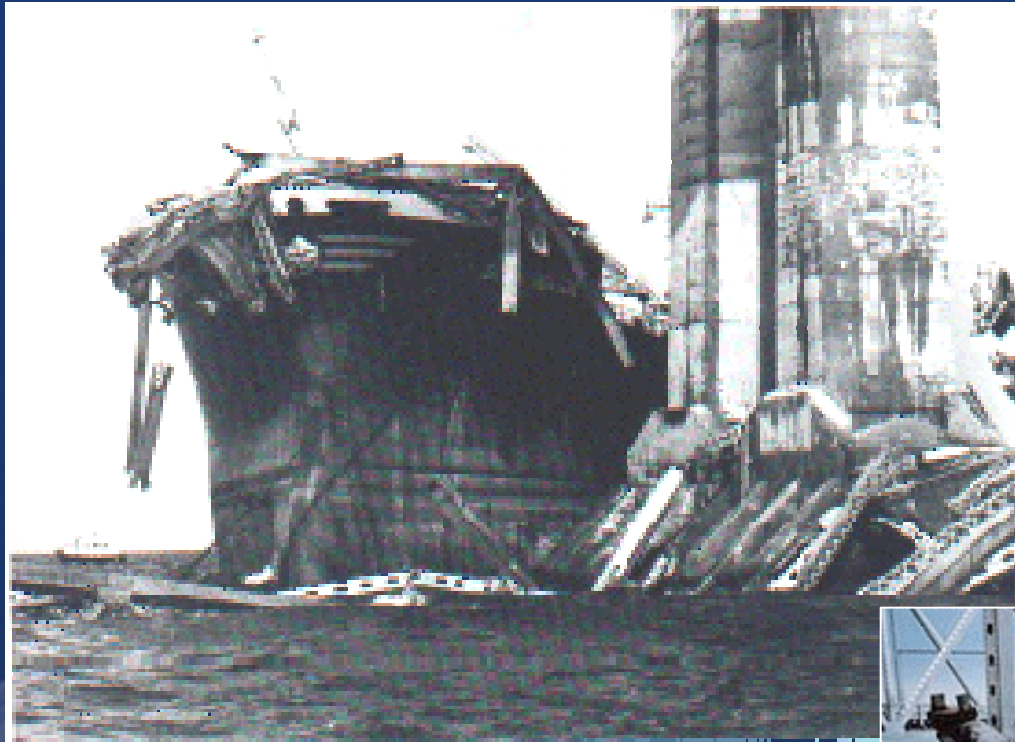
1954



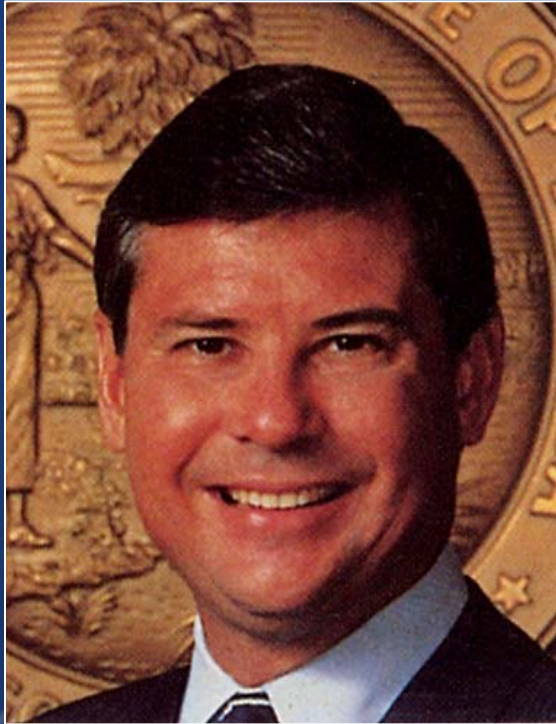
1971

# *Sunshine Skyway Bridge*

*Summit Venture  
Bridge Impact 1980*



# *Sunshine Skyway Bridge*

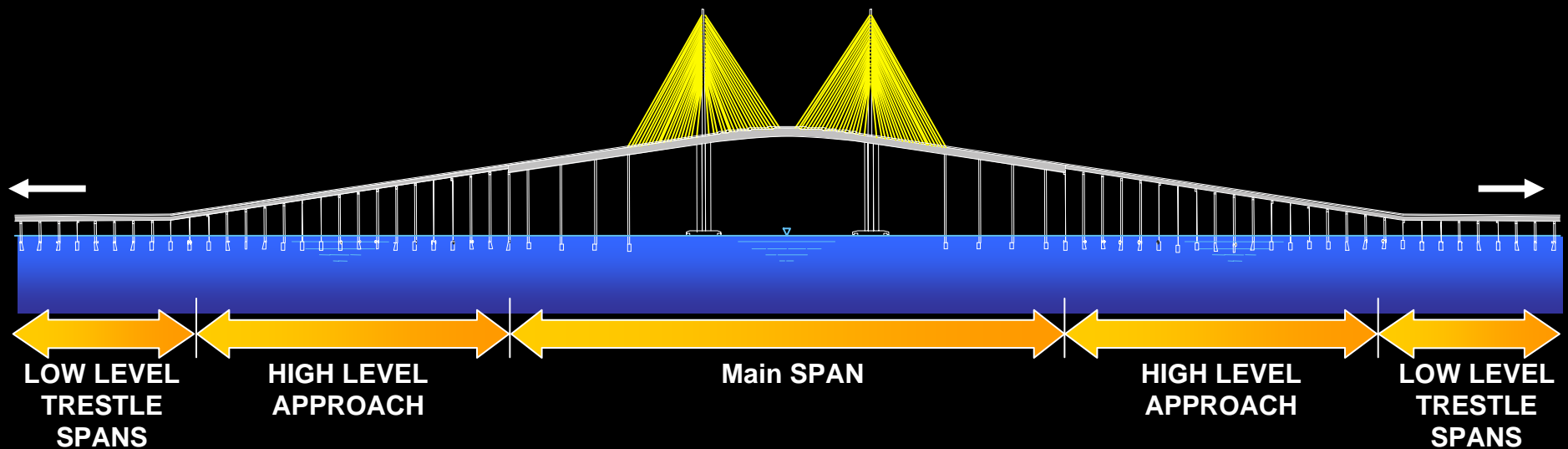


**The Vision  
Governor Graham's  
Tomorrow**

**On January 31, 1981 Gov. Bob Graham announced that the new Sunshine Skyway Bridge Would be a state-of-the-art concrete cable-stayed bridge.**

# Sunshine Skyway Bridge

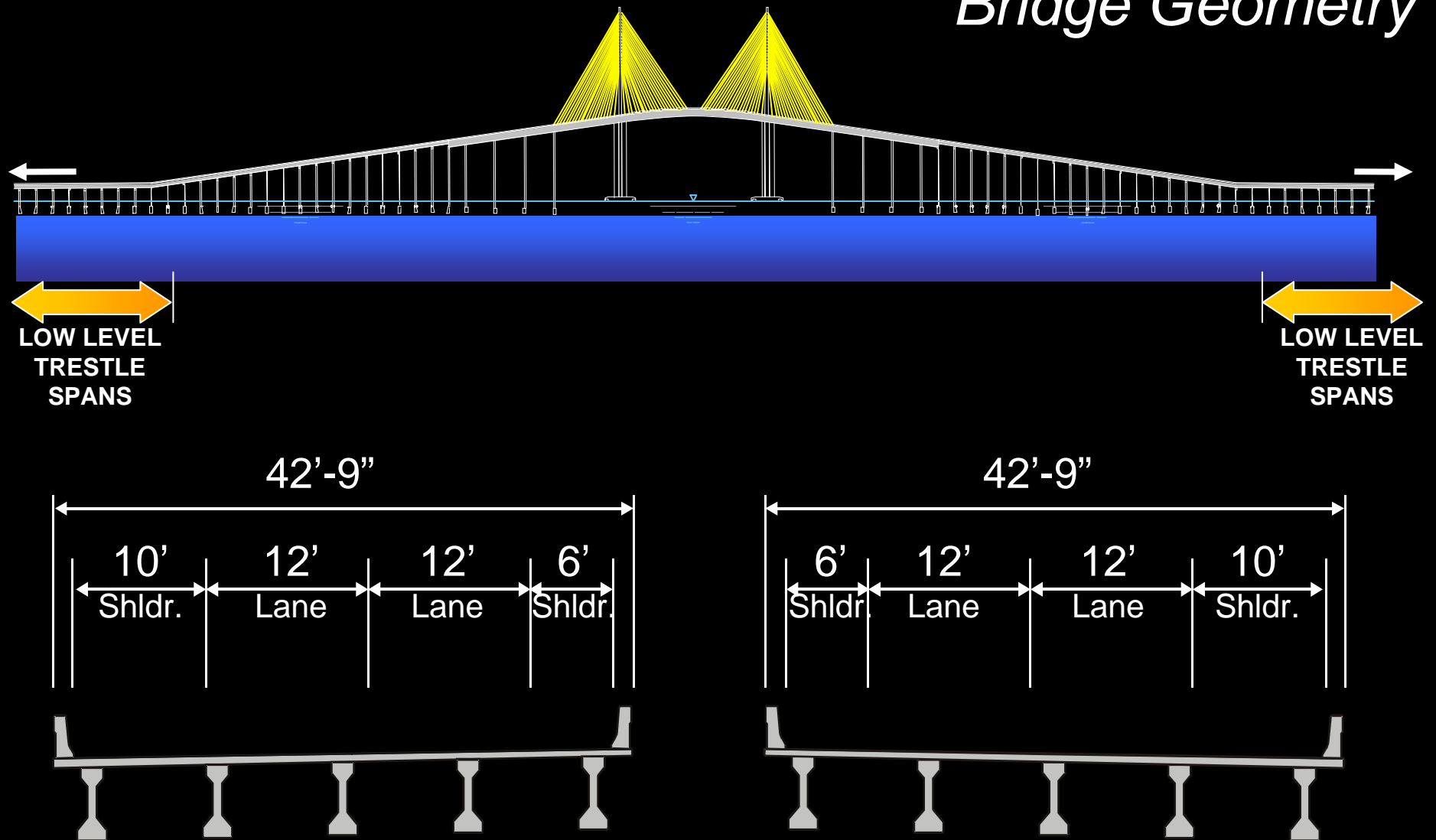
## Bridge Geometry



**Total Bridge length: 4.14 miles**

# Sunshine Skyway Bridge

## Bridge Geometry

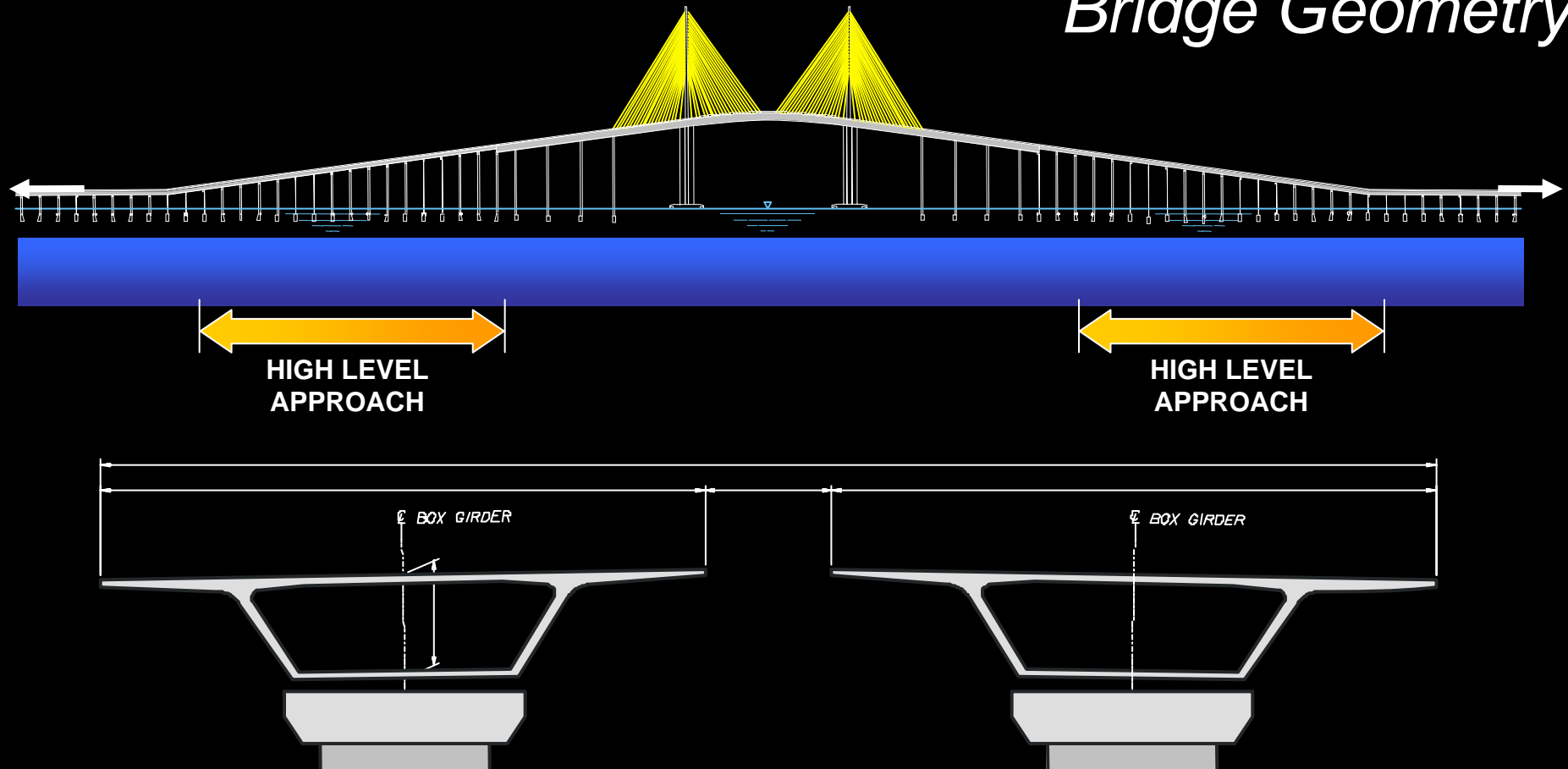


**Total Length: 13,000 ft**



# Sunshine Skyway Bridge

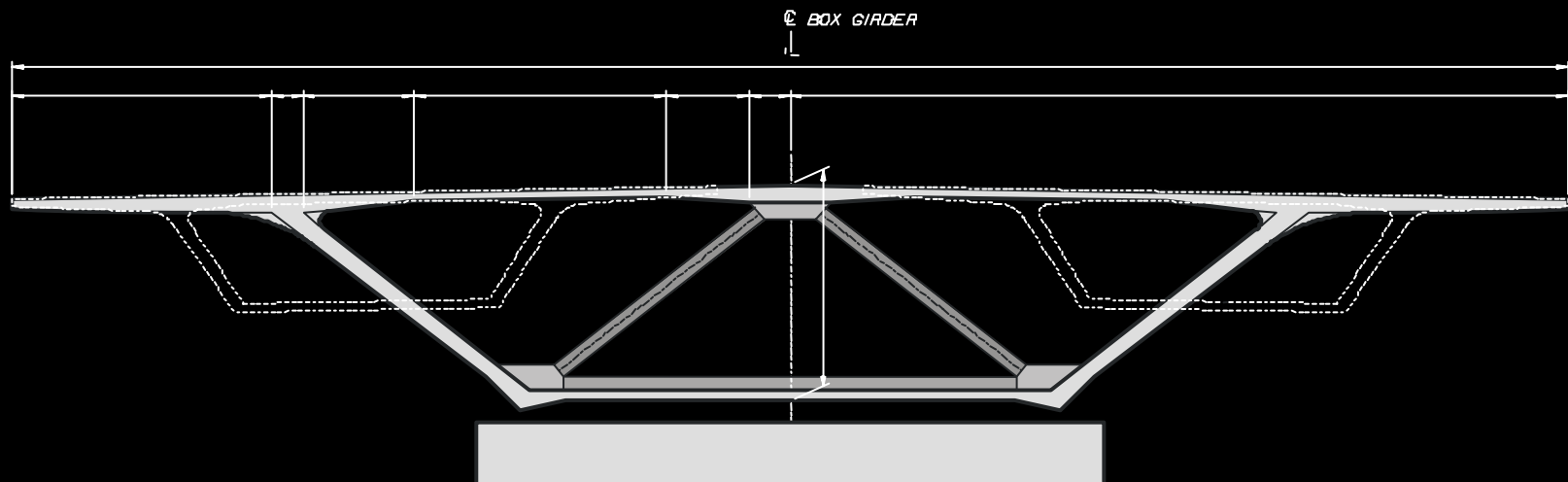
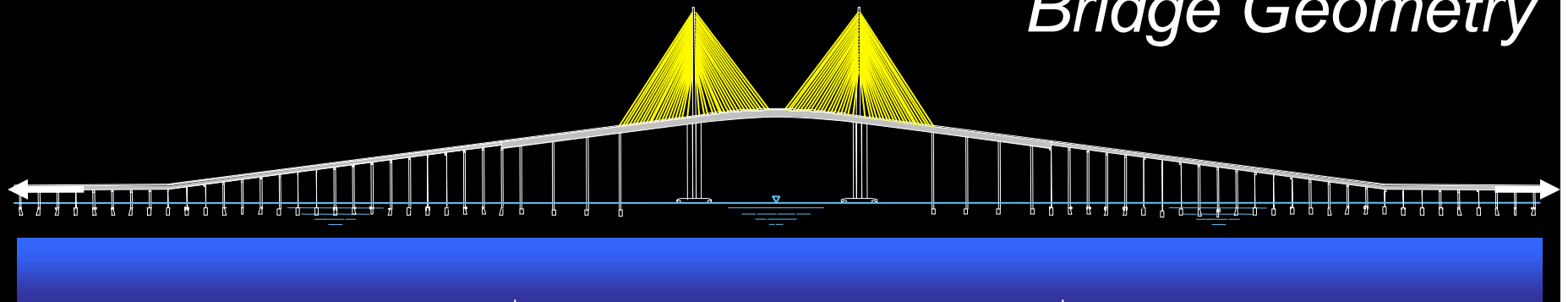
## Bridge Geometry



- **Total length: 5,000 ft**
- **Post-Tensioned Segmental Box Girders**
- **Vertically Post-Tensioned Segmental Columns**

# Sunshine Skyway Bridge

## Bridge Geometry



- **Total length: 4,000 ft**
- **Post-Tensioned Precast Segmental Box**
- **42 Continuous Stay Cables, 21 per Pylon**

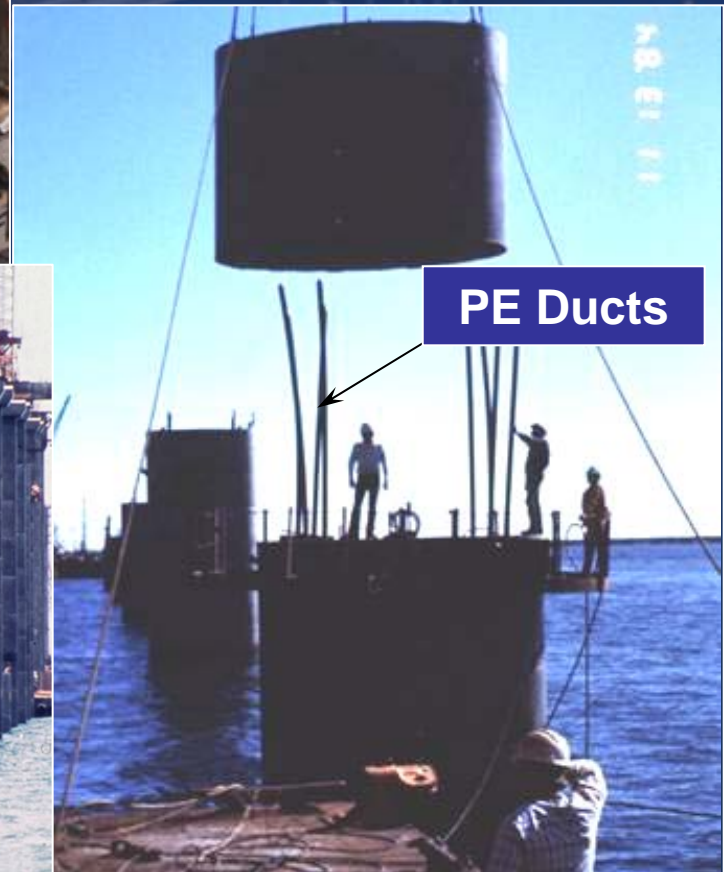
# Sunshine Skyway Bridge



High Level Approaches

Pre-Cast Column

PT Segments



PE Ducts



# *Sunshine Skyway Bridge*

*High Level Approaches  
Superstructure  
PT Segmental Construction*



# Sunshine Skyway Bridge

Main Span  
Pre-Cast  
PT Segments



June 1984...



# Sunshine Skyway Bridge

PT Cable Stays



# *Sunshine Skyway Bridge*

## *Main Span*

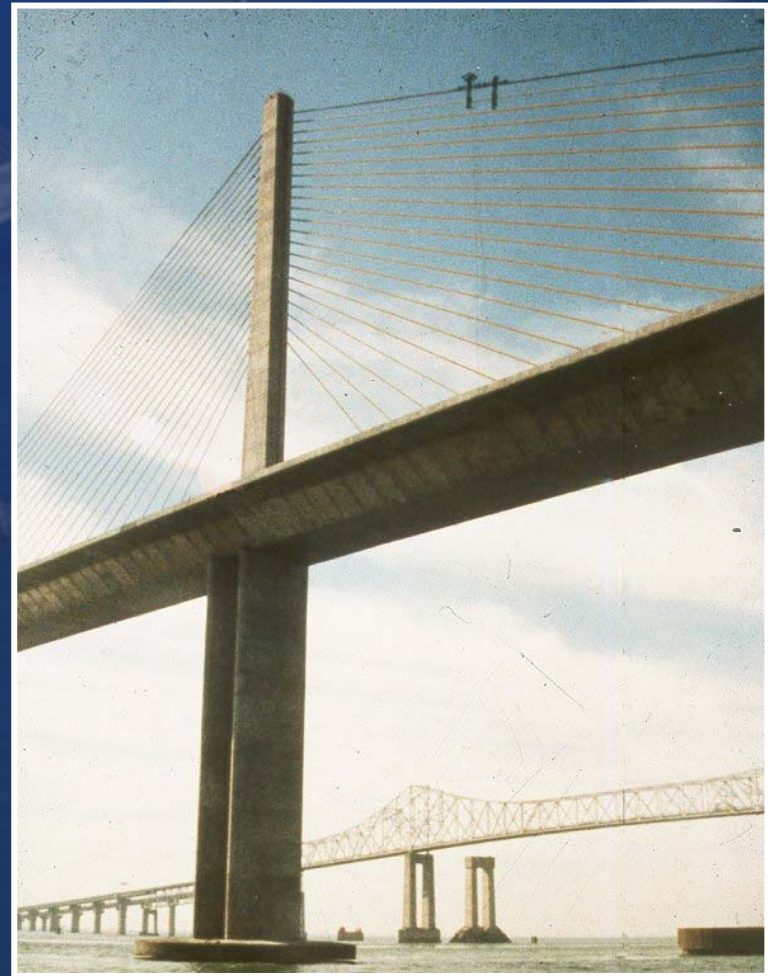


*Stay Cable Dampners*



# *Sunshine Skyway Bridge*

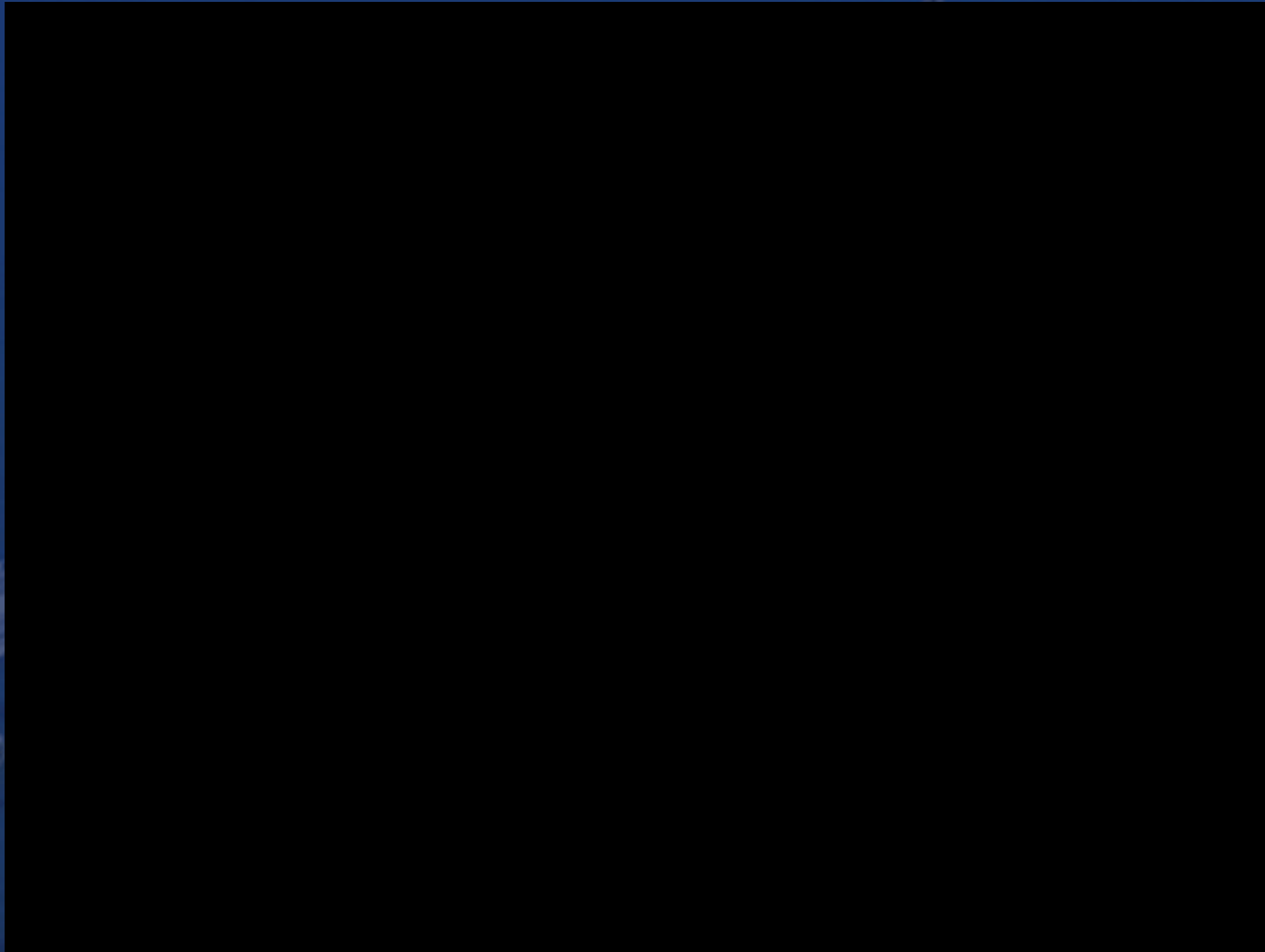
*Yesterday and Today...*





# *Sunshine Skyway Bridge*

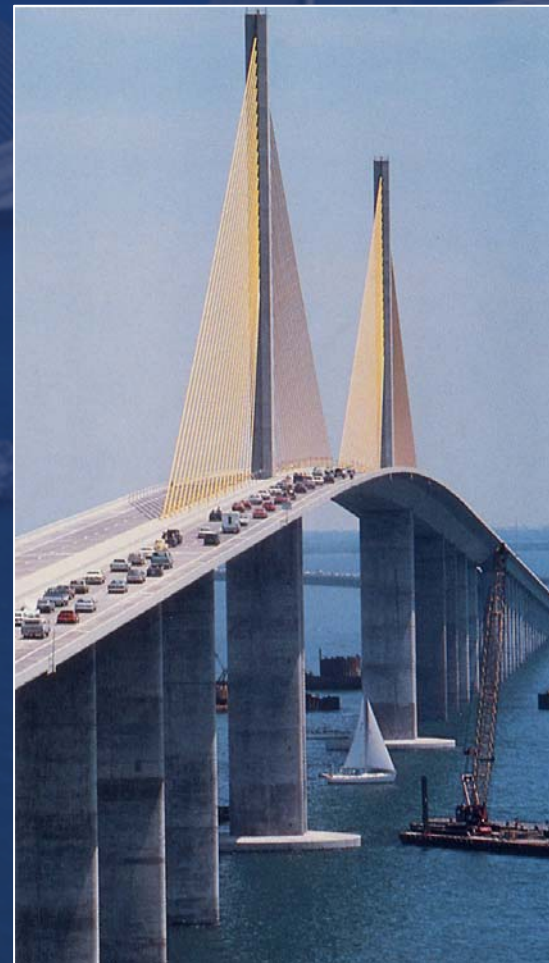
*Yesterday's Gone...*



# Sunshine Skyway Bridge

*Today...*

**Skyway Run January 11, 1987  
Over 15,000 people**



**Open to Traffic  
April 30, 1987**

# *Sunshine Skyway Bridge*

*Today...*



2/1/2002

# *Sunshine Skyway Bridge*

## *Non-Routine Maintenance*



**Armored Joint**



# *Sunshine Skyway Bridge*

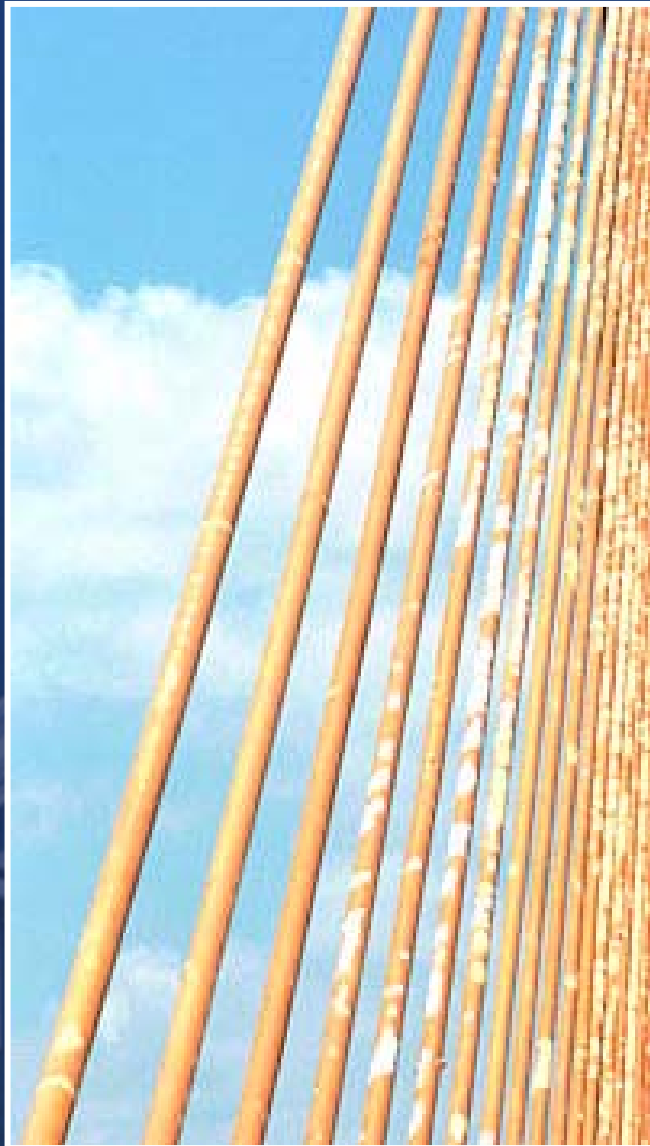
## *Non-Routine Maintenance*



**Teflon Joint  
Replacement 1993**

# *Sunshine Skyway Bridge*

## *Non-Routine Maintenance*



### *Spot Paint Project 1997*



# *Sunshine Skyway Bridge*

*Non-Routine Maintenance*

*Modular Joint Replacement*

*2001*

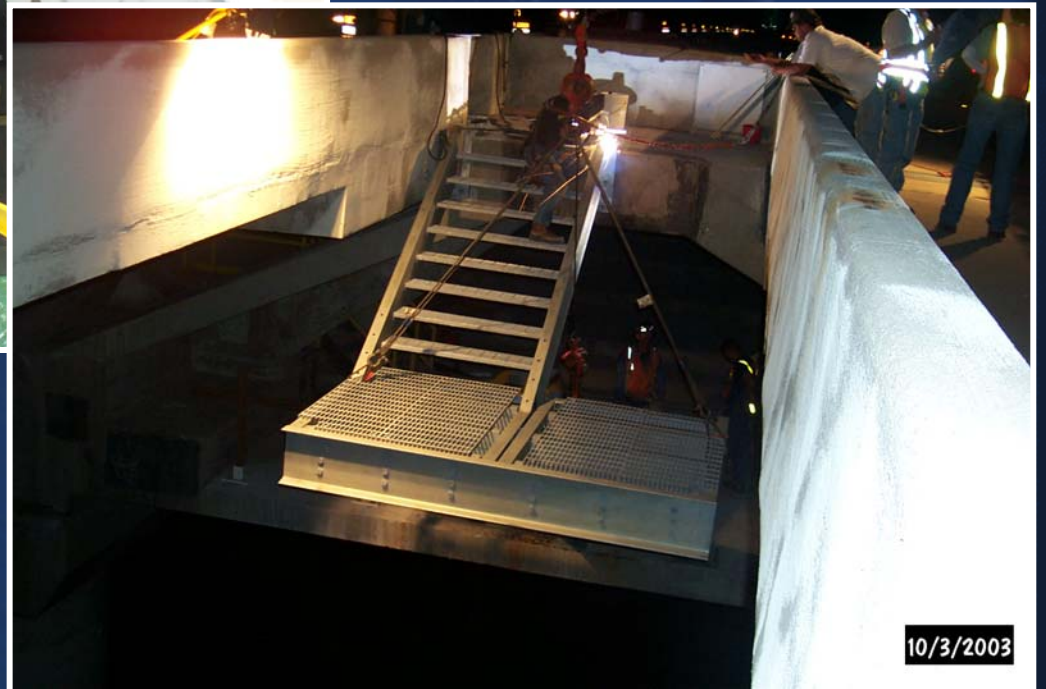


# *Sunshine Skyway Bridge*

## *Non-Routine Maintenance*



*Access Stairs  
Segmental Transition  
2003*



10/3/2003



# *Sunshine Skyway Bridge*

## *Non-Routine Maintenance*



PT Investigation  
Corrosion at  
Column 133 NB  
September 2000

9/27/2000

# *Sunshine Skyway Bridge*

## *Non-Routine Maintenance*

### **PT Investigation**

*NDT- Non-Destructive Testing*



*PT Tendon Vibration Testing*

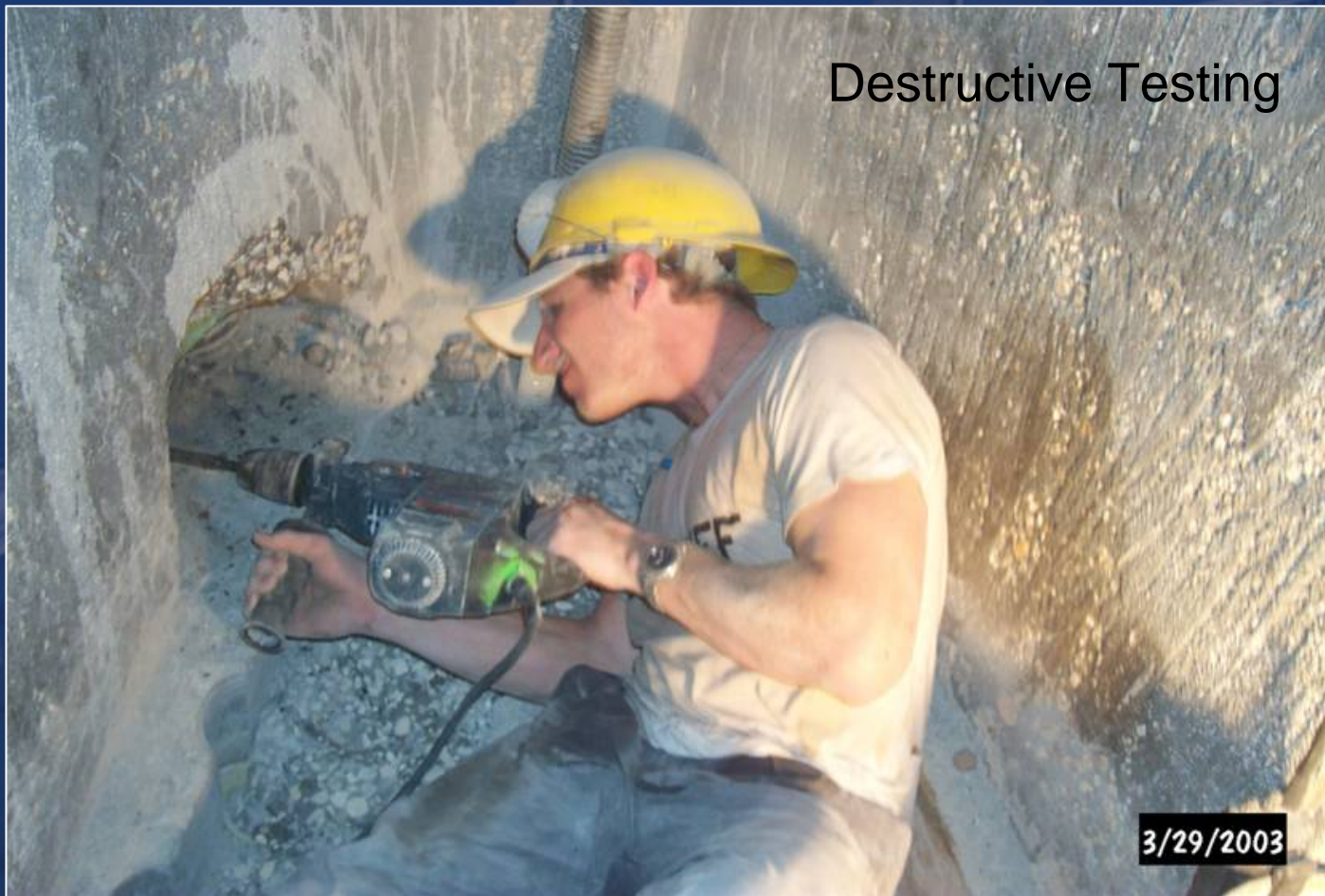
**Academia  
Collaboration**



# *Sunshine Skyway Bridge*

*Non-Routine Maintenance*

**PT Investigation**



# Non-Routine Maintenance

## PT Investigation



# *Sunshine Skyway Bridge*

## *Non-Routine Maintenance*

### **PT Investigation**



*High Level Approach  
Superstructure Inspection*

# *Sunshine Skyway Bridge*

## *Non-Routine Maintenance*

### **PT Investigation**



*Main Span  
Superstructure  
Inspection*



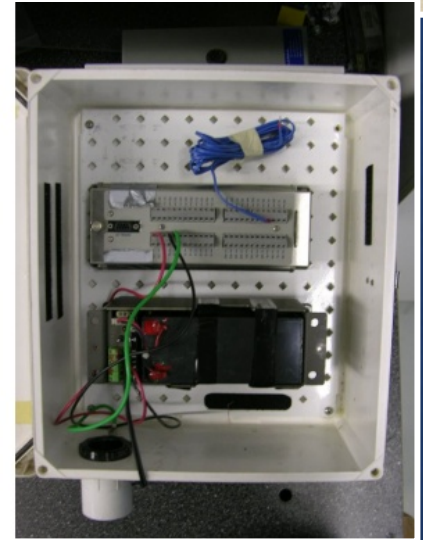
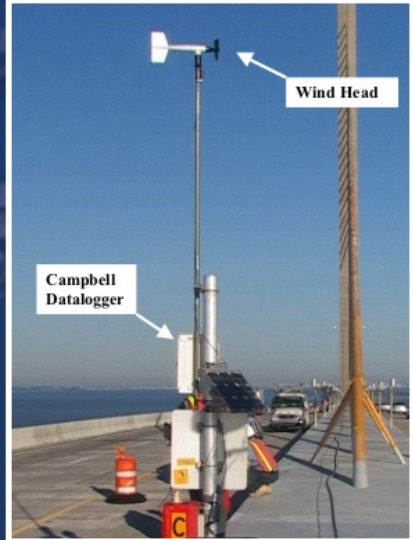
# Sunshine Skyway Bridge

## Non-Routine Maintenance



PT Investigation

Stay Cables  
Vibration Testing



# *Sunshine Skyway Bridge*

## *Non-Routine Maintenance*

### **PT Investigation Summary**

- Tendon Corrosion
- Tendon Failures
- Split/Crack PE Duct
- Grout Voids
- Contaminated Grout
- Salt Water in Hollow Columns
- Segmental Joint Leaks
- Concrete cracks
- Suspect PE Duct Quality



# *Sunshine Skyway Bridge*

## *Non-Routine Maintenance*

### **PT Repair and Maintenance Strategy**

Structural Redundancy

Restoration of Corrosion Protection

- PT Duct Wrapping
- PT Void Grouting

New Levels of Corrosion Protection

- Surface Coatings
  - Pour-backs
  - Caps
  - Main Span Median
- Watertight Joints
- New PT Corrosion Protection Strategies

Localized or Universal Repairs as Applicable

Monitoring Program

# *Sunshine Skyway Bridge*

## *Non-Routine Maintenance*

### **PT Corrosion Engineering Evaluation**

#### **Geotechnical:**

- Review of existing pile driving records
- Review of boring log
- Evaluate the existing foundation capacity (Florida Pier)

#### **Structural:**

- Global time dependent analysis model
- Finite element analysis
- Vessel Collision Risk analysis
- Evaluate structural capacity of existing column and new repair options
- FDOT PT Corrosion Protection Improvement Strategies

#### **Materials:**

- Mass concrete with fly ash or slag
- PT bars (45 mm diameter)
- Approved pre-packaged grout material
- Improve PT details
- Polymer coating (polyurethane)

# *Sunshine Skyway Bridge*

## *Non-Routine Maintenance*

### **FDOT PT Corrosion Protection Improvement Strategies**

- 2001: Revised grouting specifications
- 2001: FDOT allowed only Non-Bleed approved prepackaged grout materials
- Since 2002: FDOT New Direction for Florida Post-Tensioned Bridges
- FDOT Five Strategies
  - Strategy 1: Enhanced PT Systems
  - Strategy 2: Fully Grouted Tendons
  - Strategy 3: Multi-Layered Anchor Protection
  - Strategy 4: Watertight Bridges
  - Strategy 5: Multiple Tendon Paths

# *Sunshine Skyway Bridge*

*Non-Routine Maintenance*

*Vertical Tendon Grouting  
Mock-Up Test Set-Up*

*2003*



**PT Repairs**



# Sunshine Skyway Bridge

Non-Routine Maintenance  
Universal Repairs 2003

PT Repairs



# *Sunshine Skyway Bridge*

## *Non-Routine Maintenance*



**PT Repairs**

3/12/2003

*Inserting Bars into Box Girder*

# *Sunshine Skyway Bridge*

## *Non-Routine Maintenance*

**PT Repairs**



*Pier Cap Coating and Crack Injection*

# Sunshine Skyway Bridge

## Non-Routine Maintenance



**PT Repairs**

**Protective Sealing Repair**



# Sunshine Skyway Bridge

## PT Repairs

## Non-Routine Maintenance



*Shrink Wrap Sleeve  
PE Duct*



# Sunshine Skyway Bridge

## Today's Maintenance Plan

### Maintenance Steering Committee

- Maintenance Continuity for Expected Long Life

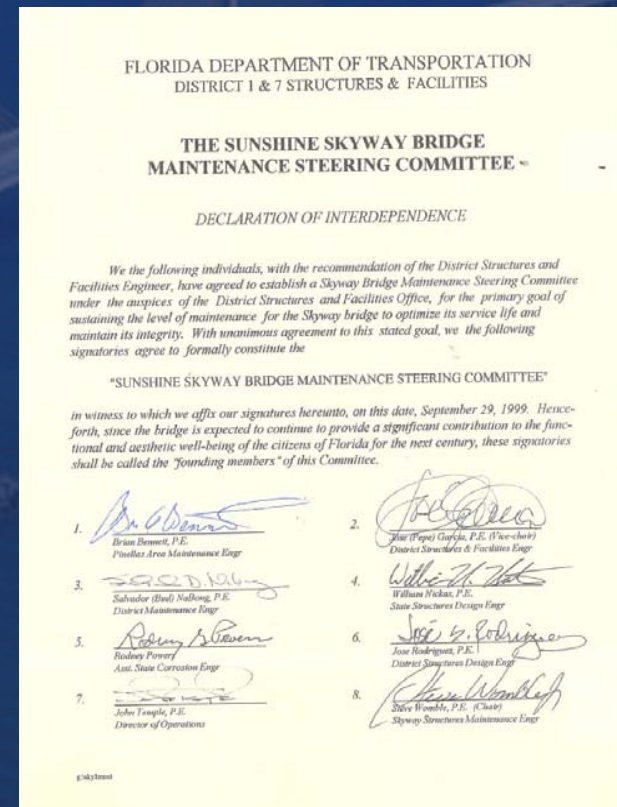
### Asset Maintenance Contract

- Inspection and Monitoring Services
- Routine Maintenance MMS 800 Series Activities
- Non-Routine (Periodic)

### Non-Routine Maintenance

- Asset Maintenance
- Project Specific
- Emergency
- Fast Response

### Engineering, Planning and Construction Management Support



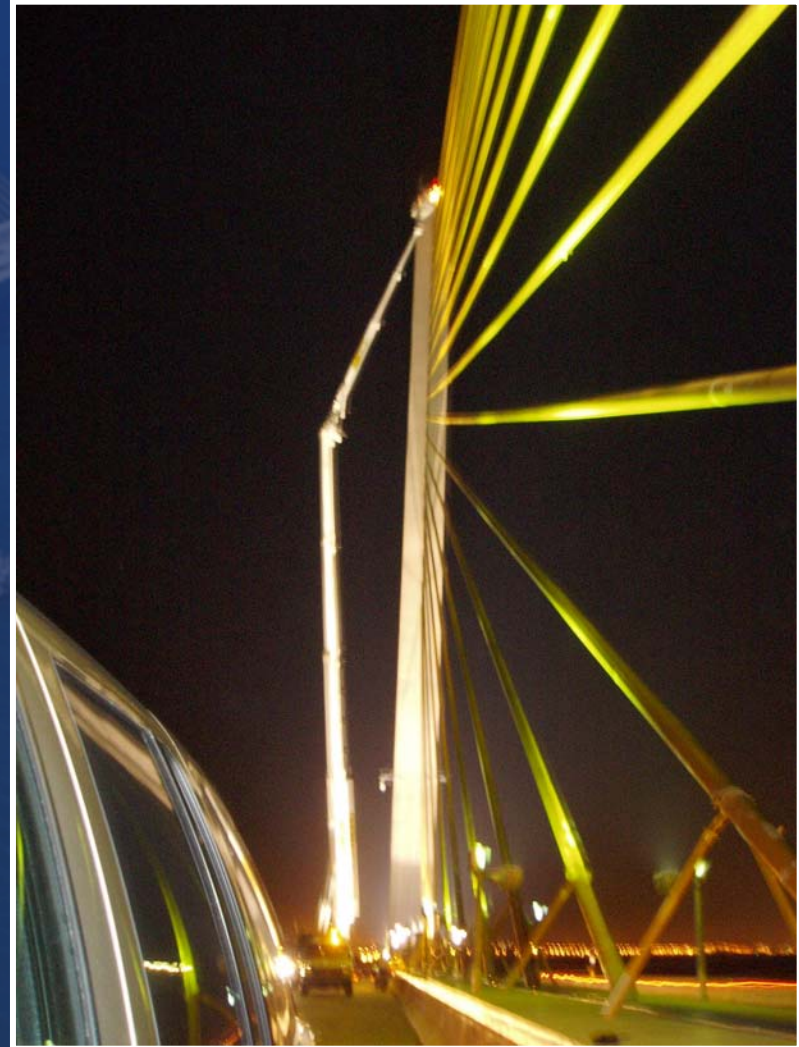
Maintenance Steering Committee  
September 1999

# *Sunshine Skyway Bridge*

*Asset Maintenance*



*Routine Bridge Inspection*



# Sunshine Skyway Bridge

Asset Maintenance

Routine Maintenance



# Sunshine Skyway Bridge

## Today's and Tomorrow's Maintenance Plan

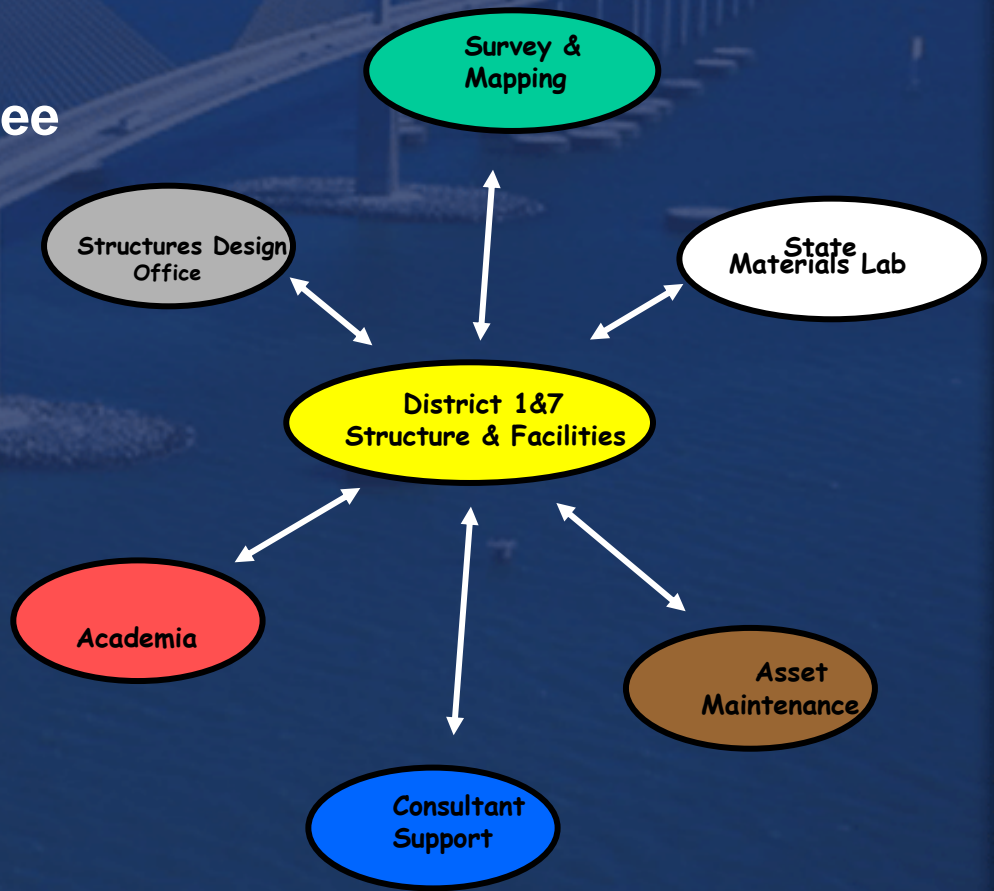
*In Summary.....*

**Maintenance Steering Committee**

**Asset Maintenance Contract**

**Non-Routine Maintenance**

**Engineering, Planning and  
Construction Management  
Support**



# *Sunshine Skyway Bridge*

*Tomorrow...*

## Immediate

- Lightning Protection System Minor Upgrade
- Cable Stay Painting and Barrier Wall Coating
- Lighting Rehabilitation
- AASHTO Beam Repairs
- Additional Global Positioning System (GPS) and Automatic Total Stations (ATS)

## Longer Term

- Continuing PT Monitoring
- Corrosion Monitoring
- Elevator Upgrade
- Security/Emergency Table Top Exercise
- Calibration of Analysis Models
- Aesthetics

# Sunshine Skyway Bridge

## Media Attention



Gene Figg  
1937 - 2002



Pepe Garcia



### Travel Channel's Top 10 Bridges

1. Golden Gate Bridge, San Francisco, California
2. Akashi Kaiyko Bridge, Kobe, Japan
- 3. Sunshine Skyway Bridge, St. Petersburg, FL**
4. Tower Bridge, London, England
5. Firth of Forth Bridge, Queensferry, Scotland
6. Brooklyn Bridge, Brooklyn, NY
7. Chesapeake Bay Bridge-Tunnel, Virginia Beach, VA
8. Sydney Harbour Bridge, Sydney, Australia
9. Leonard P. Zakim Bridge, Boston, MA
10. London Bridge, Lake havasu, AZ



*Bob Graham Sunshine Skyway Bridge*

Questions?

